INNOVATION IN SCIENCE, INNOVATION IN PSYCHOANALYSIS

Anna Carolina Lo Bianco and Fernanda Costa-Moura

Anna Carolina Lo Bianco
Universidade Federal do Rio de Janeiro (UFRJ), Professora do Instituto de Psicologia, Programa de Pós-Graduação em Teoria Psicanalítica, Rio de Janeiro/RJ, Brasil.

Fernanda Costa-Moura
Universidade Federal do Rio de Janeiro (UFRJ), Professora do Instituto de Psicologia, Programa de Pós-Graduação em Teoria Psicanalítica, Rio de Janeiro/RJ, Brasil.

ABSTRACT: The paper examines the category of innovation in the light of its relations to scientific procedures. It then observes the consequences of the current use of innovation for the conception of a speaking subject and the act he/she performs. It takes the complex course of the history of science using wide time units to demonstrate the important traces left by the progress of science in the past centuries. It then shows that despite seeming far from our day to day life, operations carried on with mathematics, and especially geometry, constitutes the intellectual structure in which we are involved. It concludes that innovation having become mandatory paradoxically wards off the very novelty responsible for bringing around the speaking subject.
Keywords: innovation; novelty; science; psychoanalysis.

RESUMO: Inovação na ciência, inovação na psicanálise. O artigo examina o estatuto da inovação nos dias de hoje, relacionando-o aos procedimentos da ciência e procurando ver as suas consequências para as concepções de sujeito e de ato. Toma o complexo curso da história da ciência, recorrendo a unidades de tempo amplas, para demonstrar as importantes marcas deixadas ao longo dos últimos séculos. Mostra em seguida que, a despeito de aparentemente afastadas de nosso cotidiano, as operações matemáticas alteram a ordem do discurso onde o sujeito se constitui. Conclui que a inovação se torna obrigatória na ciência, o que paradoxalmente a afasta do novo que faz surgir o sujeito.
Palavras-chave: psicanálise; ciência; novo; inovação; sujeito.

DOI - http://dx.doi.org/10.1590/1809-44142017002010

From the rarely made use of the term "to innovate" before the 16th century (BLOCH & VON WARTBURG, 2004), we have come, nowadays, to a mandatory use of it. Things are such, that we have, today, a Ministry of Science, Technology and Innovation. Certainly, it is not a mere coincidence that the use of the term is, from that time forth, increasingly more frequent, to the point of its appearance in the name of a Ministry becoming necessary. In the present paper, we sought to discuss the relations between science and innovation, in order to interrogate the nature of the latter and, most of all, assess the consequences of such relations with the intent to undertake a deeper reflection concerning the operations of science that touch the field of the subject.

We start by bringing some crucial events in the establishment of modern science that, as we intend to demonstrate, left important marks and introduced, without the shadow of a doubt, novelty and innovation in the form of that which we came to consider the world and the universe of which it came to be a part of. For such, we'll deal with some broad unities of time, apparently apart from our daily time and reality, but that shed light on our relation with science, which goes much farther than the learning or the application of one or another theory, of one or another theorem to a determined field. Before that, we will be following the constitution of an "intellectual structure" and of a formal discursive plane in which we became immerse from that inaugural section forth and to which we are increasingly appended in the contemporary social order.

THE NEW REAL

It is Galileo himself that, in 1610, speaks of the "great things" he has to present in his *Sidereus Nuncius* treaty. Great, he says, because of its "intrinsic excellency" and because of the "absolute novelty" it contains (apud KOYRÉ, 1975/2006a, pp. 80-81). It concerns new facts: mountains on the moon, new planets in the sky, new stars that no eye or human mind had previously seen or conceived. "Staggering", "unexpected" and "unpredictable facts" that could be discovered by the invention of a new instrument, a novelty itself. The *perspicillum*, a sort of telescope that brought the stars closer to us in such a way that they could be seen and, obviously, studied.

The enlargement of the frontiers of this world is now identified, making it, thus, more interesting than the other world; similarly, the life that lives in it raise more questions than the life one would lead in the divine, supernatural world. Through that same blow, space ceases to be a positive space, identified with extension and places and becomes a mathematical one requiring, for its apprehension, a presumptive geometrical reasoning. From that point forth and specially after, with Descartes and Newton, the prevailing cosmic order is

questioned. Opposing the cosmos conception underpinning an entire field of perception and experience ordained by sense, the geometric space introduced by modern science cannot be the object of common perception and experience. The cosmos, conceived up until then as a finite world, closed and hierarchically ordained, gives way to an "infinite universe" (or, at least, indefinite), ruled by components that are neither limited or explained by its attributes and, on the contrary, follow fundamental rules (KOYRÉ, 1975/2006b).

Hence, emerges the so called "scientific thinking" that puts aside considerations based on values such as "perfection, harmony, meaning and objective", and establishes a fundamental separation between the "world of values" and "the world of facts" (KOYRÉ, 1975/2006b, p.6). Facts that give substance to a scientifically articulated knowledge.

Koyré (1975/2006b) also draws attention to the fact that the established novelty brings, concomitantly, a profound and more fundamental transformation, through which the world itself on which we lived, is lost. That demands new ways of conceiving the real and, even more, a complete transformation of those who inhabit this world and think it. However, what is at stake in this attitude of transformation (that is also a "philosophical attitude", as Koyré puts it) (1971/1991b, p. 208) are, as we pass into this "world of facts", the values attributed to intellectual knowledge and, in no way, its experimental, empirical and phenomenist aspect. Even if experience and experimentation are strongly present in the history of science, even if what is emphasized is the fertility of experimentation in opposition to the sterility of speculation, what rules the universe of precision is not a naive empiricism but a "mathematical realism"(KOYRÉ, 1971/1991b, p.212). A realism that is in no way whatsoever referred to the application of mathematics and geometry's exact notions to a given real.

The mathematization present in the origins of modern science doesn't simply consist in quantification or mensuration. It is not just a matter of the sensitive substance receiving a mathematical precision as a new varnish. On the contrary, in order for nature to present itself to Galileo as "written in mathematical characters", the order itself of what we call nature had to be already conceived according to the principles of mathematical reason (HENRY, 1998). Only thus can this nature be apprehended in an calculation network. A network that equates the sensible differences of so called natural phenomenons so to make them "fit" in science's deductive procedure (PRIGOGINE & STENGERS, 1984).

There is much more to this than the substitution of a natural language for another, mathematical one. There is the engendering of a universo of precision cut apart from all of the culture, all of the intellectual thinking that came before. Before the emergence of Galileo, Descartes and Newton's physics, it seemed impossible to apply to the sublunar world the exigency of precision. The world

in which we exist and live our daily lives is not mathematical, not even mathematicable. It is the terrain of the "almost", a moving and imprecise ground (KOYRÉ, 1971/1991a, p.272). And this abyss that existed between the world and nature on one hand and mathematical exactitude on the other, constituted the great obstacle for the emergence of mathematical physics such as we know today. It is true that the Greek already admitted that the Heavens had regular movements that were in accord with geometry's more rigid and stricter laws. But the Heavens are not the earth. And it was not possible, before Brahe, Kepler e Newton to assess the consequences of celestial movement in order to mathematize the movement of earth. Without this, mathematical astronomy, aimed to movements and to celestial stars, could, even so, be conceivable whereas mathematical physics, couldn't.

What makes the difference between Aristotle, for example, and the moderns is, precisely, that the Aristotelian conception is not a mathematicable one, for it depends on sense. This makes it obsolete when considering actual conceptions[1]. Similarly, alchemy, even accumulating observational and empirical treasures and producing an instrument set that chemistry itself inherited, was never able to accomplish an exact experience. Even if material conditions to make a measurement existed, alchemy lacked the idea that it was possible to measure with precision. As Koyré formulates (1971/1991a, p.278), "it's not that Alchemy didn't have the thermometer; what it lacked was the idea that heat is susceptible of an exact measurement". That is why the alchemist contents himself with common sense terms such as "live fire, slow fire", etc. It's not technical insufficiency but the absence of an entire rationality sustaining the operation.

OF MACHINES AND INSTRUMENTS

Mathematization brought with itself not only its rigor, but also the fact that is operable, which produced new instruments. And it was precisely through these instruments, like Galileo's *perspicillum*, which are no more than incarnated theories (BACHELARD, 1938/1996), that exactitude came to constitute our world. Exactitude didn't emerge from an intelligent action that only allowed the record, the classification or the ordination of common sense facts. And neither didi it come from the accumulation of knowledge that would allow for the "summary" or the "generalization" capable of promoting the "extension of a knowledge acquired through practice" KOYRÉ, 1971/1991a, p.274). As Koyré demonstrates, Descartes goes exactly the opposite way. Instead of an intellectual attitude applicable to the

[1] Although, none the less powerful; we nowadays still live in this Aristotelian conception of the world ordained by the sense, the world of more or less.

world of more or less that we inhabit, as a conduct affixed to the functioning of this world, what he does is to secure a new capacity. The attitude of making theory penetrate and impregnate action. What we have now is the conversion of theory into the real; the "possibility, simultaneously, of technology and of physics" (KOYRÉ, 1971/1991a, p.275).

Before that (during the 16th and 17th centuries), machines were conceived through a mechanical, approximative way — idealized in their structure and functioning through drawings and incipient descriptions, restricted by real dimension and, thus, by extension. There was no calculus present in the constitution itself of the machine, since calculus requires all of the new *beforehand* rationality that what we tried to indicate above. They were machines of a more or less world; a world (it was the world of the Middle Ages, of Renaissance, as it was the world of Antiquity) where calculus wasn't established as a prerogative. As we said, a few astronomical calculations were made, mainly based on geometry, but there were no numeric calculations. There wasn't even available an algebraic language, nor a regular arithmetic one capable of giving support to the algorithm (KOYRÉ, 1971/1991a) . The use of Arabic numerals and of the decimal base were in no way widespread and, on the contrary, their introduction in everyday life a substitutes to the roman ones, faced a strong resistance. (KAPLAN, 1999) — and how difficult would it be to proceed in any arithmetic operations whatsoever with roman numbers! According to Koyré (1971/1991a), although Pythagoras had already proclaimed that the number is the essence of things, no one believed him. And, at least until Galileo, no one dared to surpass the practical use of numbers, of weights, of measurement (that could, for example, be expressed in roman numbers) in order to make of them an element of precise knowledge (that demanded the decimal system and arabic numerals.)

Under the term of science, however, an act of intelligence already treats a machine and its gears (and even the world, the universe) mathematically, that is, the same way it treats an equation and its factors. A machine, a phenomenon of the universe or a device (today "hard" or "soft") is decomposed and recomposed and its constitution, its structure and the functioning of its dynamics and mechanisms are examined with the same proceeding through which an equation is approached (and, possibly, decomposed), so that a precise result of its use is obtained. The knowledge that thereby emerges, arises through calculus and not only from a spontaneous development of industrial arts. In fact, it is because theory is, thus, converted into practice that Descartes awaits and hoes for the progress and the innovations that will make humans rulers and owners of nature.

We usually believe that new types of knowledge allow advances and constitute innovation, but it is important to be aware of the radical difference between the emergence of new tools (used for something specific) and the emergence

of a theoretical instrument that appears in determined moment of the course of science, opening, thus, the possibility of a real operation, impossible without it. Cultures always could, independently of scientific thought, create tools and machines whose perfection e utility certainly came form the human ability to "invent" an "innovate". But to know the "fact" of light refraction is not the same as knowing its laws — as it was done only afterwards, with Kepler and Descartes. In that regard, an eyeglass maker (a craft that existed since the Middle Ages) was a craftsman and in no way an optician. He worked according to his craft's traditional rules and wouldn't go beyond. He didn't make an optical instrument (like the *perspicillum*) but a tool, that is, something that extends and reinforces de action of our limbs and organs of the senses, but that will never make us go beyond the world of common sense. This is precisely the instrument's major function (KOYRÉ, 1971/1991a).

As Koyré puts it (1970/1991a), as daunting as it may seem, during four centuries, no one had the initiative to see what would happen if instead of using one pair of lenses, as used on glasses, two were simultaneously used, as used on Galileo's telescope. What actually happened is that the telescope only turned Galileo's theory real. Eyeglasses manufacturers could do nothing alike precisely because they "lacked the theoretical instrument that inspired and guided Galileo" (KOYRÈ, 1971/1991a, p.279). And they also didn't share the same purpose. Eyeglasses are devices in a practical sense. They allow us to see further than human sight would reach in certain cases. But the idea is to see the same thing human could reach given, for example, a smaller distance. On the contrary, it was because of an eminently theoretical need, the "need to achieve that which is *not achievable by our senses*; to see that which no one had ever seen before" (idem, p. 280, our emphasis), that Galileo built his "mathematical machines" (idem). Machines such as the telescope and afterwards, the microscope, that already presupposed the substitution of the more or less sphere by the universe of precision in the making of their inventors. The practical use of the devices that would later dazzle the world of commerce and industry, is nothing more than a by-product, when its theoretical purpose — that was to undertake the fusion of celestial physics and earthly physics — was what really allowed the section made by the entry of precision in the "world of more or less".

Similarly, the development of calculus as a mathematical instrument was the first big revolution undertaken by Newton. Let us dwell a bit on this notion of calculus that can possibly establish on different bases, the problematics of innovation. It comes from the possibility to represent a algebraic formula on a chart, which is useful when working with sequences, with too big or small a magnitude, with infinite sequences, etc. Hence, when dealing with problem to which no solutions could be found in the representational sequence of natural

numbers, calculus allows to find a geometrical or arithmetical solution for some of these algebraic problems. In ancient Greece, Archimedes already conceived a mathematical astronomy and invented a geometrical solution to determine de area of a circle. But it was Newton that introduced in calculations de dimension of time[2] and developed a solution (that can be algebraic and arithmetic) to lead with number and magnitudes that (contrary to what happens with the fractions of Greek mathematics) can't be reconducted back to the unity (PUECH, 1990). It's what we, nowadays, know as differential and infinitesimal calculus: a symbolic proceeding through which real change or variation (continuous, intervallic or discreet and sudden, disruptive) can be mathematically detected, verified, apprehended.

Neither calculus nor the telescope appear as the extension or the advancement of the senses already previously constituted. Newton paid attention to the necessity of completely new mathematics, and that came from his conceptual comprehension of physics. Calculus itself is the novelty, which was not evident and, as it emerges, alters the real. It's not something that appears because we anticipated it in our plan, neither because it will make things easier for us, or will be useful in some function that we'll accomplish; it is rather an instrument that, rigorously speaking, emerges from a section (KOYRÉ, 1975/2006b), a theoretical act (LO BIANCO & COSTA-MOURA, 2013), unimaginable and unpredictable in principle. Something that in the most literal sense of the term, comes from the incarnation of spirit, the materialization of thought (BACHELARD, 1938/1996). And, we can add, in this case, the materialization of mathematical thought.

NOVELTY AND INNOVATION

What Newton introduces with the formalization of mathematical physics establishes the problematics of novelty on other bases. From that point forth, physics collects the real of change without trying to apprehend what novelty actual is. It renounces to explain the ontological nature of change and occupies itself, for example, with giving an operational access, a measurable reason of movement. With this, it starts referring itself to a real that dispenses semantics, a real of equivalent elements, whose problems and impasses can be referred to the syntactic and differential game that is calculus itself. But the effects of this maneuver are not restricted to a gain of exactitude. There is an additional effect that the mathematization of the real implies: it is now the mathematical — and longer the sensible or even the plane of representations — that stands as the real.

[2] Considering the curve from which one pulls the tangent, not as a circumvented entity but as the graphical expression of a movement (a variation).

Science formulates "hypothesis to conciliate its experiments and then employs these experiments to verify the hypothesis" ARENDT, 1958/2007, p.300). And that is how science becomes institutional, academic, tied to the knowledge and result thatin the end, produce, primarily, science itself.

That doesn't happen in classic science. Arendt (1958/2007) still argues that we find in the science of the 20th century the project of modern science and the reproduction of the same closed-on-themselves paradigms, allegedly "neutral" and "non-political"[3], referred, first and foremost, to epistemological structures created by science itself. Contemporary physics, for instance, which was born out of the spalling of the scientific project of the 17th and 18th centuries, turns to, predominantly, indeterministic questions, that is, to problems that introduced uncertainty (Heisenberg and Planck) and the incompleteness of knowledge (Einstein) in the field of knowledge itself. But, nevertheless, it still presents questions that are eminently classical ones from the scientific point of view (ARENDT, 1958/2007; LATOUR, 1998/2011). It is worth saying that, even having Einstein, Planck and Heisenberg locating as no one before the crisis of scientific thought paradigms and leading to unprecedented reflections, they all have, each in their own way, sought to re-signify and reorganize scientific methodology oriented by the new experiences of physics. And even when it was not possible to achieve it inside the current scientific frame, they invented, so to speak, "new physics" that, albeit "new", in nothing strayed from the proceeding that are specific to mathematized science.

Of course, the eruption of novelty can happen in science, but it is immediately made null by science itself, because of rigid formal and pre-established agreements through which science can "neutralize" that which would be innovation. According to Walckoff, Machado & Farias (2016, p.31), Arendt sees in this "renovation but [also] restoration" process of the scientific order, "the circularity and the falsification of science's own innovation", present in modern scientific methodology itself.

We nowadays consume technoscience's by-products tools as novelties. They are present in our lives — and make our credit cards bills more expensive — in ways that vastly surpass the scope of what would be a new, more perfected knowledge of the world. Instead of providing knowledge, science risks becoming the support for a pragmatic totalitarianism, organized around a logic that

[3] In a very interesting observation, Walckoff, Machado & Farias (2016, p.31) indicate that, contrary to what a certain ideology claims, politics (in the arendtian meaning of the word) is inexorably present in the context of science, because science does politics even when trying not do it. Is suffices to observe the emergence of nuclear weapons, of the chemical industry, medicine and the experiments with the body, etc. (On the compromise of science with politics and human problems, see also FERNANDES & COSTA-MOURA, 2009).

pretend to rationally explain everything, to the point as to leave no more space to the subject (LACAN, 1965/1966, Lesson of 1/06/66 — we'll come back to this further on).

Lebrun (1977) shows how this totalizing tendency of science expands and risks losing its breaks during the course of technical development. Each emergence of a new theoretical instrument makes way, sooner or later, to the insertion of this instrument as part of the production of consumer products that will feed machines (computers, microchips), softwares or corporations and, ultimately, each one of us who increasingly desire a real *ready-made*, as Duchamp would say (idem). In our daily lives, we know that we don'y have the 'need' of a smartphone and, on the contrary, its later use and utilities only appear after its invention. However, ever since such an object exists, we can no longer live without it, nor without the "innovation" through which the iPhone 6 will necessarily make way to the 7, o 7S, o 8, etc.

This allows us to see how innovation differs from novelty. Novelty concerns invention. It's not the results of an accumulation of knowledge or its natural progress. It is, more specifically, an event, the act of a subject, Newton, for example, or Galileo or Heisenberg, that produces the advent of calculus, the Galilean revolution or the principle of uncertainty. Innovation, on the other hand, is produced in the context of a mere combination of resources that generates new products, new processes, new markets, new forms of organization and new materials. Whereas novelty is contingent, innovation is part of scientific operation and is, so to speak, foreseen by it.

That is why the question that must be asked is if or in what conditions can we speak here of novelty.

In a previous paper (FERNANDES & COSTA-MOURA, 2009), we pointed to three algebraic operations that impose themselves and are direct by-products of the formalization of language and whose incidence on the discursive order clearly shows the results of science in social life. They are operations that alter the ordinary functioning of language, reducing ordinary (multifaceted) language to a first order formalizable logic. It is important to emphasize that this is not the result of an ideological manipulation but of maneuvers inherent to formalization.

Let's take the "closing" property as an example. This property can give us an idea of what "mandatory innovation" means, which is already present in the field of the formal language.

As an algebraic structure, the closing property is presented under an axiom written $\forall\, a_i\, a_j \in \mathbb{C}, \exists\, a_k$ so that $a_i * a_j = a_k$ and enunciated as follows: "to every a index i (any given thing) (a_i) and every a index j (any other given thing) (a_j), we find one and only one given thing (a_k) as a result from the operation of the thing index i, with the thing index j. Even though the algorithm that writes this axiom

isn't easily intuitive, it demonstrates that it concerns an operation with letters, a formal operation that will have dramatic consequences to the way we think.

This axiom writes a formal property that can be illustrated as follows: a given number (a_i) operated (*) with another given number (a_j) has another given number as a result (a_k). In other words, when we add 2 + 5 the result will inevitably be the number 7. Not another number, "not any object such as a thermos", but only the number 7 (FERNANDES & COSTA-MOURA, 2009, p. 156). That is to say, the "closing" property generates a specific engagement that prevails whether or not we adhere to it and is independent from any intention we might have: a commitment that no matter what transformation might be produced by an operation, for it to be valid, it has to guarantee beforehand that its product be "ontologically" identical to those two other things united by the operation.

We should observe that this property intends to control (or at least narrow to certain parameters) precisely the signifier dimension of language. The dimension that maintains a place for the subject at the same time that it supports the occurrence of the difference (not its annulment). Lacan (1961-2) puts forward a matheme to write the language potential not to close itself, but to redouble over itself and to bring to light, the field of the Other — the field of language that exceeds the subject's understanding and action, but precisely where it takes root. It is the matheme $S = S \Leftrightarrow S \neq S$ that is read as: "the Signifier is the Signifier if and only if the Signifier is different from the Signifier". Lacan's bet is to show that the occurrence of the signifier that constitutes the subject's field is retroactive to a given signifier, over the significance granted to the former signifiers. This signifier's return over the others is a part of the language's structure itself. The mere emergence of a given signifier in a sentence necessarily causes this retroaction. Moreover, this occurrence creates in every sentence a difference that impossible to assimilate, an "empty place" to the "interpretation" of the subject; some sort of compartmentalization of significance, that waits and demands the presence of a subject to be completed. This division is therefore essential to the language so that it can articulate a place in which the subject could emerge.

The "closing" excludes from the operation beforehand precisely that which will appear in the language as an event or historicity; in other words, the arrival of an (other) order that ruptures with a previous given order. The remarkable aspect of this is that its effect happens through a formal compromise which will determine in a definitive manner the possible results of the operation. Hence, how can we think innovation if the closing limits the order of events itself? Where the formal operation happens, the results are presented in chain, a result, followed by another and so on. The results are necessarily reached. Wouldn't we be making the power of innovation, or the power of language to create, fruitless?

If we take the closing property as it is in the mathematization of space, for instance, we will see which of language's vectors are inhibited or "domesticated" to maintain that which gave birth to modern physics. From the Newtonian perspective, everything that happens is produced in space and everything that happens in space happens in a specific way. That is to say that it is possible to establish the position (or the result) of what happens from a deducible chain. Furthermore, everything that happens presumes the space as the place where articulations and connections between things and certain events happen. Therefore, we have an operation whose result or conclusion is drawn mandatorily from one or more propositions taken as premises, to a proposition that constitutes its own necessary consequence due to logical rules.

However, in ordinary language, the notion of space includes other dimension that go beyond mathematical ones. Firstly, in any natural language, not everything that happens, happens in extent; there's the occult, the non-reachable, myths and religious expressions that, in various forms, reflect what does not happen in extent. Consequently, not everything that happens to the subject happens in a way that can be formalized. Not everything obeys a determined composition law (for example, there is the illogical, the indefinite, the mysterious, etc.). It is perfectly acceptable that an accident occurs, the contingencies are considered and it is possible to find something completely heterogeneous to what is expected in certain circumstances.

It is this possibility of eruption of ruptures and sections that the property of closing narrows, once every state of things is inscribed there as a possible deduction of formalism. On this matter, we should revisit our original question. How can we think innovation, where closing limits the results' variation down to the computable range of the operation itself?

In the conjunction between science and capitalism, this maneuver repeats itself, maintaining the economy and making it operate the specific way in which this system does (LACAN, 1968-69/2008). In capitalism, historicity is reduced to economic progress. There are instruments that guarantee that the next step taken will pertain to the previous moment range, as if every transformation were restricted and should necessarily emphasize the accumulation of capital. The place of the market in this system illustrates the closing exigency: everything produced by men (including its own workforce) is merchandise and has a unique and calculated vectorization value. There is no rupture, the variations are always subject to neutralization — habit changes are rapidly incorporated to fashion — adjusted to the market's cruel mechanisms of offer and demand (COSTA-MOURA & FERNANDES, 2011).

In this domain, there is no change, nor actual transformation, as it is extremely difficult for them to happen, due to every result being deducible and

contained in the operation that is incessantly repeated. On the contrary, this repetition is not even automatic, but acephalous: once such premises are given, there is no way not to "not-innovate". Going back to the example given before, of a "smart" cellphone, we could say that its ramifications are only a matter of calculation, and they are a given ever since the existence of the iPhone 1. Every result, every *output* of its replication will bring new functionalities: the camera will have more pixels, the keyboard will accept dictation better, etc. Innovation is necessary and mandatory. Indispensable in such a way that it becomes necessary to have a Ministry to manage it; innovation programmed and deducible to the point that "innovation managers" came to exist in several institutions (governmental or not).

IT IS A NOVELTY TO SEE THE SUBJECT APPEAR

Let's turn to the subject that Freud envisioned as the subject of the unconscious. By taking the concept of the signifier, the core of Lacan's return to Freud, which finds in the language the conditions for the emergence of the subject, we come to the conclusion that the subject is an effect of the signifier (LACAN, 1960[1966]/1998). A subject that is spoken; an effect of the language structure that speaks through him, even before he used the word himself (LACAN, 1969-1970/1992). If the subject is subject to the signifier, we can envision, at this point, the fall or exclusion that Lacan calls the "foreclosure" of the subject (LACAN, 1965-66 — lesson of 06/01/66), which befalls a subject of the "world of the more-or-less" due to the necessary upturn on which the articulation of "universe of precision" depends.

Febvre (2003) states that one who lives in a world in which mathematics is still elementary, does not have its reason developed the same way that another who, albeit ignorant or incapable of solving an equation or a complicated problem by himself, lives in a society devoted to the precision of mathematical reasoning, the accuracy of calculation, the elegant ways to demonstrate. According to Febvre, it's as if our modern life was embedded by mathematics. Not only do we find ourselves intertwined by a rationality that didn't exist before, but actually everything we can learn is already built in this universe that emerges, modifying the discourse and the language of which we are effect.

Accordingly, the place of the subject tends to disappear and is slowly but steadily being replaced by the "being" of the mental problems, the phobias, the righteous citizen or the consumer linked to the market's gadgets. When science takes the subject into consideration it is to take him as the vanishing point for the calculation (for example, in the Theory of Games, in linguistics) and, in the context of capitalist societies, reinstate it in the calculation for the demand.

Science puts the subject of the unconscious into the world, so to speak, when it forecloses him from its operation. Once the field of the signifier was transformed into the mastery of statements knowledge made of little axiomatic letters, the subject loses its place in language and is exiled, foreclosed from the symbolic net (LACAN, 1965-6/1998). Therefore, when Lacan speaks of the foreclosure of the subject by science, it is to describe this specific exclusion mode of the subject by science in a way that necessarily entails the effect of the return to the Real of the subject as unconscious[4]. It is through this return that we can speak of a subject that emerges as a subject of science. This is also where psychoanalysis appears as a social bond, different from others in that it reinstates the place of the subject of the unconscious and desire into scientific consideration.

Psychoanalysis isn't a pre-scientific knowledge that is built or established without taking into consideration the section inflicted by science. It does not advocate a return to a previous world, prior to science, nor does it put itself as "another type" of science that offers itself as an alternative to the latter. This is not also about establishing what are or were the "influences" that science would have had over psychoanalysis, since the latter appears from the same section that creates science and the infinite universe — and challenges the relationship between mankind and the world. Lacan insists on several occasions that the subject with which psychoanalysis operates "can't be any other than the subject of science" (LACAN, 1965[1966] 1998, p.873) and even the Real as we experience it, presents itself to the subject as a presence of the impossible, having its origin in this Real devoid of sense, reduced to the minimum produced by formalization — and especially on formalization impasse (LACAN, 1972-73/1985). However, if psychoanalysis is born in the context of a culture dominated by science and by the knowledge that its procedures engender, the soil in which psychoanalysis grows is the one that science put aside when it was constituted.

To establish the laws that rule the real, science overlooks that which can't be reduced to those laws, in other words, the act, the subjective operation that produced them. Therefore, what is in fact relevant to psychoanalysis, on the matter of the progress of science in which we find ourselves today, is to assert that amidst the chaos of science, in its thrust to an automated deducibility, something resists and can't be apprehended by calculation. Something that thrives as a vanishing point. On this matter, Lacan says, "it is new to see a subject appear" (LACAN, 1964/1985, p.169).

[4] Lacan (1965-66, lesson of 06/01/66) states that science forecloses the subject, referring to the term *Verwerfung* used by Freud to name the mechanism of defense through which the subject gets rid of an idea that affected him, but ends up having to deal with the onus of its return. This return does not happen in the register of the symbolic, but rather as a "return from outside"; a (into the) real return , never fully able to be symbolized.

Lacan thus defines the emergence of the subject. As the novelty that erupts, and is contingent. His brief formulation leads us to the power of the event. Here, there, anywhere, in discourse or even in each and every one of us, in the point where the signifier field would close — which Lacan refers both to the constitution of scientific knowledge and to the establishment of a circuit of *jouissance* drive (1964/1985) — "it is new to see a subject appear".

Hence, in psychoanalysis, the subject is the novelty. At the same time, an element of structure — as a return of what was once foreclosed from the symbolic net and that emerges necessarily into the Real — and absolute contingency. In other words, the subject is an element of radical contingency that limits structural determinism, making what the concept of structure is to psychoanalysis. A structure that contains in itself the place for the choice of a contradictory subject that arises precisely from this choice. It is worth mentioning that in psychoanalysis, the resolve, contingent, is an effect of the signifier. However, in addition to that, the resolve is created from this element that embodies a central contingency, immovable, that is the emergence and the advent of the subject (SILVA, 2011).

Because of the subject's condition of only existing under the language bond, the presence of the subject entails its fostering, and an ethical assumption of what returns (by the *lapsus*, the Freudian slip, the symptom, for example), as its own. Concerning this, Lacan formulates the subject as a novelty. The real return of the subject (which is necessary) isn't enough. For there to be an effective presence of the subject in the order of the real, it is still necessary for the subject to have a place in the discourse, in the social bond. And that is an ethical choice. Contingent. A choice continuously made and maintained through an act.

If we go back to Freud's act, of inventing psychoanalysis, we can get a bit closer to what this contingency of the subject's advent is as an ethical choice.

In the first lesson of the unpublished Seminar *The Psychoanalytic Act* (1967-8), Lacan takes into consideration Cantor's demonstration of the existence of the real number and asks: "[...] is it the case [to suppose] that this order [of the real number] had always been there, waiting for Cantor's operation"? (LACAN, 1967-8, lesson of 15/11/67).

It is possible to recognize in Lacan the intent of making of science and its operative concepts a direct theme, notably of that which science orbits around and produces: mathematics with its foundation on the letter. It seems that this is not so much to insist on psychoanalysis' scientific side, but mostly to determine in what way it is a science's effect and what are its responsibilities in a world imprinted by the presence of science. When we question Cantor's demonstration, we can see Lacan dwelling on the problem of the real in terms of what would have been there before knowledge or before a subject that would

emerge from knowledge, which is in some way, equivalent. Is it the real that have always been there?

It is in this context that Lacan puts Freud's act. Whenever one speaks of the birth of psychoanalysis — which is dated, as we will see ahead, all it took was an act from Freud — also appears the question whether the field that psychoanalysis organize would have been operating before Freud. Thus, before psychoanalysis itself. Lacan points out that it is a question that is always important to ask when considering Freud's act, for all the chances of its previous existence are there, wherein the unconscious would operate and have its effects felt long before Freud and the birth of psychoanalysis. However, Lacan summons us to go further, and while lifting the first question, he asks another. A question concerning the fact that, even if the unconscious order operated in full before Freud, could we ask: [but] "who knew"? (LACAN, 1967-76, lesson of 15/11/67).

We can thus think that Freud's act of inventing psychoanalysis isn't so much about him being able to target and reinstate the desire as sexual and unconscious in the field of cogitations. He isolated the unconscious, which is inherent to the machine that produces sense and significance. After Freud, the machine that, with linguistics but mainly with Lacan, would be called the signifier, language. A machine that produces itself the sexual. Freud undoubtedly did that. And that is of the utmost importance. What is at issue is the affirmation of the subject as a responsible instance in the discourse. A subject that chooses and takes stand, without it being an extent entity, something "out-of-language". Without reducing it to the bedrock that would secure the physicochemical exchanges, nor relapsing into transcendentalism, which science itself has made obsolete. It is the reasoning on the language operation that liberates psychoanalysis from ontology and places the fulfillment of subjectivity under the plan of ethics. It is not in vain that we see in contemporary biophysical reductionism an attempt to return (under science's wings) to a state of things prior to Freud's. An apprehension of our impasses and pathologies that would be independent from the stance of the subject, the desire, the sexual. With that, we yield on the ethical question that is introduced by psychoanalysis as a question within the movement of the language itself of never completing the significance and leaving to the subject its responsibility.

It is important to repeat: Freud took this step. But perhaps his act wouldn't have existed, wouldn't have prevailed as such, if he wasn't able to create a practice at the same time. A device capable of giving a place to the subject, and putting within his reach an ethical choice of his emergence as a subject to be held responsible and take into his own hands what operates unconsciously. Thus, it is from Lacan's direction that we propose that what Freud brought to the world was undoubtedly in fact, "who knew about it". It was the subject as such. A

subject that does not refer to the Platonic truth that resides in the interior of the soul, nor to the truth of the human thought on Aristotelian science, but to a truth that isn't whole nor knowledge. A subject that can't be fully spoken, or calculated and whose troubling presence is above all an immovable remainder of the whole calculation process (LACAN 1972-3/1985).

If innovation is mandatory in science, to psychoanalysis it is contingent. It is connected to the act. Or should we say that the act is what bring the novelty to psychoanalysis. Initially, Freud's act reinstated the subject of the sexual unconscious into the order of the discourse but, ultimately, the act of every subject that arises from an act of assumption of the language laws. A subject that is "new to see appear" from the act.

In the first lesson of 1968, on the same Seminar on *The Psychoanalytic Act* (1967-1968, lesson of 10/01/68), Lacan makes a direct relation between the new and the act. He observes that we speak of a New Year, but at its closing, it restarts. However, the year — like many other elements that we call the real — doesn't really have a beginning. Since it is a cycle, an act is necessary for it to have a starting point. The same act that sets its ending. If we go even further, we could say that every beginning is an act. It is a section made through a significant demarcation — notably when it is required to unveil a beginning precisely where there isn't one.

In order to dramatize what's most radical in Lacan's proposal, we could say that we don't really start a diet on Monday, but rather, that we will know that we are on Monday (and that there will even exist a Monday) when we will start the diet. However, the beginning of the year is especially favorable for us to realize that an act doesn't really fit into precision. Actually, in the real, there aren't any "exact cycles" that could be apprehended directly and fully through calculation. If we coded the beginning of the year in one cipher, we would do that leaving aside the fact that a signifier "doesn't exactly adhere to the real" (LACAN, idem). In other words, the signifier — unlike the formalized letter from the science operation — doesn't write the real in an axiomatic fashion. It is about a judgment, which we could also call "an inauguration". It is about a happening, and this is where the new (a new year, for instance) depends upon an act.

Thus, it is in the scope of a happening that psychoanalysis locates the subject as an effect of the act. Freud formulates this idea through the imperative *Wo Es war soll Ich werden*. As an act that previously ("*war*") constituted the subject, who should ("*soll*") then take it into his own name.

It is a novelty to see a subject appear every time, from the most ordinary speech — precisely from the potentially subversive and troubling one, which modern science decided to mitigate with its by-product, the technical revolution from the 17th and 18th centuries.

Since an act of speech always bears something that is significant, something that thrives, averse to the wholeness of knowledge, to the massive organization of representation, in psychoanalysis, by its structure, we are far from the obligation of innovation; even further away from its management. In psychoanalysis, it is first and foremost about rising to the event. It is about the contingent emergence of an ethical position. It is about choice, about fostering, about undergoing, about abiding (or not) by the dimension of the act that makes way to the new subject.

Received: October 7, 2015. Accepted: October 1, 2016.

REFERENCES

ARENDT, H. *A condição humana* (1957). 12ª Edição Revista. Rio de Janeiro: Forense Universitária, 2014.

BLOCH, O.; VON WARTBURG, W. *Dictionnaire étymologique de la langue française*, Paris: Quadrige, PUF, 2004.

BACHELARD, G. *A formação do espírito científico* (1938). Rio de Janeiro: Contraponto, 1996.

COSTA-MOURA, F.; FERNANDES, F. L. A psicanálise existe? Considerações sobre o materialismo da psicanálise. In: LO BIANCO, A.C. (org.). *A materialidade da psicanálise*. Rio de Janeiro: Contra Capa, 2011.

FEBVRE, L. *Le problème de l'incroyance au XVIe siècle*. Paris: Albin Michel, 2003.

FERNANDES, F.L.; COSTA-MOURA, F. Lógica da ciência, formalismo e forclusão do sujeito. In: COSTA-MOURA, F. (org.). *Psicanálise e laço social*. Rio de Janeiro: 7letras, 2009.

HENRY, J. *A revolução científica e as origens da ciência moderna*. Rio de Janeiro: J. Zahar, 1998.

KAPLAN, R. *The nothing that is: a natural history of zero*. Oxford: Oxford University Press, 1999.

KOYRÉ, A. Do mundo do "mais ou menos" ao universo da precisão (1971). In: *Estudos de história do pensamento filosófico*. Rio de Janeiro: Forense Universitária, 1991a.

_____. Da influência das concepções filosóficas sobre a evolução das teorias científicas (1971). In: *Estudos de história do pensamento filosófico*. Rio: Forense Universitária, 1991b.

KOYRÉ, A. Coisas que ninguém nunca viu antes e pensamentos que ninguém teve: a descoberta de novos astros no espaço físico e a materialização do espaço — Galileu e Descartes (1975). In: _____. *Do mundo fechado ao universo infinito*. Rio de Janeiro: Forense Universitária, 2006a.

KOYRÉ, A. Introdução (1975). In: *Do mundo fechado ao universo infinito*. Rio: Forense Universitária, 2006b.

LACAN, J. A ciência e a verdade (1965-1966). In: _____. *Escritos*. Rio de Janeiro: J. Zahar, 1998.

_____. *De um Outro ao outro* (1968-1969). Rio de Janeiro: J. Zahar, 2008. (*O seminário*, 16).

_____. *L'acte psychanalytique* (1967-1968). Seminário inédito.
_____. *L´Identification* (1961-1962). Seminário inédito.
_____. *L'objet de la psychanalyse* (1965-1966). Seminário inédito.
_____. *Mais, ainda* (1972-1973). Rio de Janeiro: J. Zahar, 1985. (O seminário, 20).
_____. *Os quatro conceitos fundamentais da psicanálise* (1964). Rio de Janeiro: J. Zahar, 1985. (*O seminário*, 11).
_____. Subversão do sujeito e dialética do desejo no inconsciente freudiano (1960[1966]). In: _____. *Escritos*. Rio de Janeiro: J. Zahar, 1998.
LATOUR, B. *Ciência em ação*: como seguir cientistas e engenheiros sociedade afora (1998). São Paulo: Unesp, 2011.
LEBRUN, J. P. *Un monde sans limite*. Ramonville Sainte-Agne: Erès, 1997.
LO BIANCO, A. C.; COSTA-MOURA, F. Ato teórico, ato ético. In: *Tempo psicanalítico*. Vol. 45, n. 2, dez. 2013. Disponível em: <http://pepsic.bvsalud.org/scielo.php?script=sci_arttext&pid=S0101-48382013000200002&lng=pt&nrm=iso>. Acesso em: 27 jun 2016.
PRIGOGINE, I.; STENGERS, I. A nova aliança: metamorfose da ciência. Brasília: Editora Universidade de Brasília, 1984.
PUECH, M. *Kant et la causalité*. Paris: Librairie Philosophique J. Vrin, 1990.
SILVA, M. E. de A. *Sujeito e estrutura: uma articulação ética*. Tese de Doutorado defendida no Programa de Pós-graduação em Teoria Psicanalítica — UFRJ. Rio de Janeiro; 2011. Disponível em: <http://teopsic.psicologia.ufrj.br/arquivos/documentos/1ECCBF6E3CE97AD0207E40C7B9D59027.pdf>. Acesso em: 27 jun 2016.
WALCKOFF, S.D.B.; MACHADO, M.A.C.; FARIAS, R.de J.C. A ciência e o novo: uma reflexão sobre a ação e a tradição na ciência. In: *Investigação qualitativa em educação*. Vol. 1 (Atas CIAIQ 2016).

Anna Carolina Lo Bianco
aclobianco@uol.com.br

Fernanda Costa-Moura
costamouraf@gmail.com

Traduzido do português por *Lourenço Astúa de Moraes e Anna Luiza Almeida* / translated from portuguese by *Lourenço Astúa de Moraes and Anna Luiza Almeida*.

Lourenço Astúa de Moraes — Pontifícia Universidade Católica do Rio de Janeiro (PUC-Rio), Mestre pelo Programa de Pós-Graduação em Psicologia Clínica, Rio de Janeiro/RJ, Brasil.
Anna Luiza de Almeida e Silva — Universidade Paris VIII, Mestrado em Psicanálise, Saint-Denis, França.

Lourenço Astúa de Moraes
l.astua@gmail.com

Anna Luiza de Almeida e Silva
annaluizaas@gmail.com